Public Health and Ecological Interconnectivity: A Conditional Probability Approach Associating Degradation of Streams and Infant Mortality

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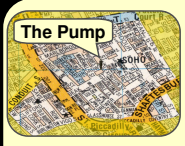
Public Health Goal

Major improvements in public health by reductions in pervasive diseases



John Snow

Pump linked to cholera outbreak

Problem was viewed as health effect (mortality from cholera in population)

Tracked back to water pump as likely source of exposure

Current Approach

Clinical exposure-based studies on individuals determine causation, but there are thousands of exposure agents.
This implies possible large expenditure of funds on studies with no adverse health effects

Possible Improvement

Use Snow's large-scale approach as a screen and then follow with appropriately designed individual-based studies

Death Records

Demographic barometer of community health since 19th century

Mortality and morbidity data still collected and publicly available in CDC national data bases

Suggested Approach

Explore associations between infant mortality and environmental conditions (look for patterns in associations) for more effective public health intervention

Infant Mortality

Major health status indicator of populations and available at the county level of aggregation

Environmental Condition

Health of bottom-dwelling communities in streams is integrative of recent water quality degradation and reflective of environmental condition

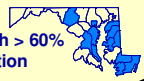
Intent of This Research

Explore possible relationship between environmental condition and infant mortality

Indicator of Public Health: probability of infant mortality rate (IMR) greater than 8.2/1000 (national norm for 1989-98)

Indicator of E-Condition: percent of stream miles degraded (low score for benthic index)

MD counties with IMR > 8.2/1000



MD counties with > 60% stream degradation

For Maryland counties, is there a relationship between degraded stream condition and infant mortality?

Formulate and test as null hypothesis

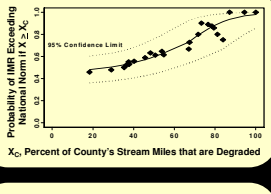
Conditional Probability

Probability of something occurring when something else has occurred

Example: Probability of IMR in a county > 8.2 per 1000 if at least half of streams in county are degraded, P (Y | X ≥ 50%)

Results

Empirical conditional probability curve



There is a real association

(but it is not cause-effect)

Make the association quantitative by trying to disprove null hypothesis

Null Hypothesis

$P (Y | X \geq X_C) = P (Y)$

or

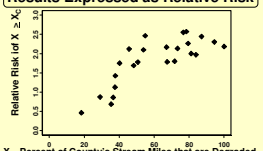
conditional probability equals unconditional probability

Result of bootstrap resampling

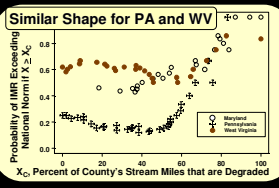
Less than 2 % chance that $P (Y | X > 78\%) = P (Y)$ could have occurred randomly

Null hypothesis disproven!

Results Expressed as Relative Risk



Similar Shape for PA and WV



What would you conclude from these results? What are the next steps?

Please share your thoughts with us on post-it notes.

Our Conclusions and Next Steps are on handout.

Conclusions

Next Steps